

SDSS-II Management Plan

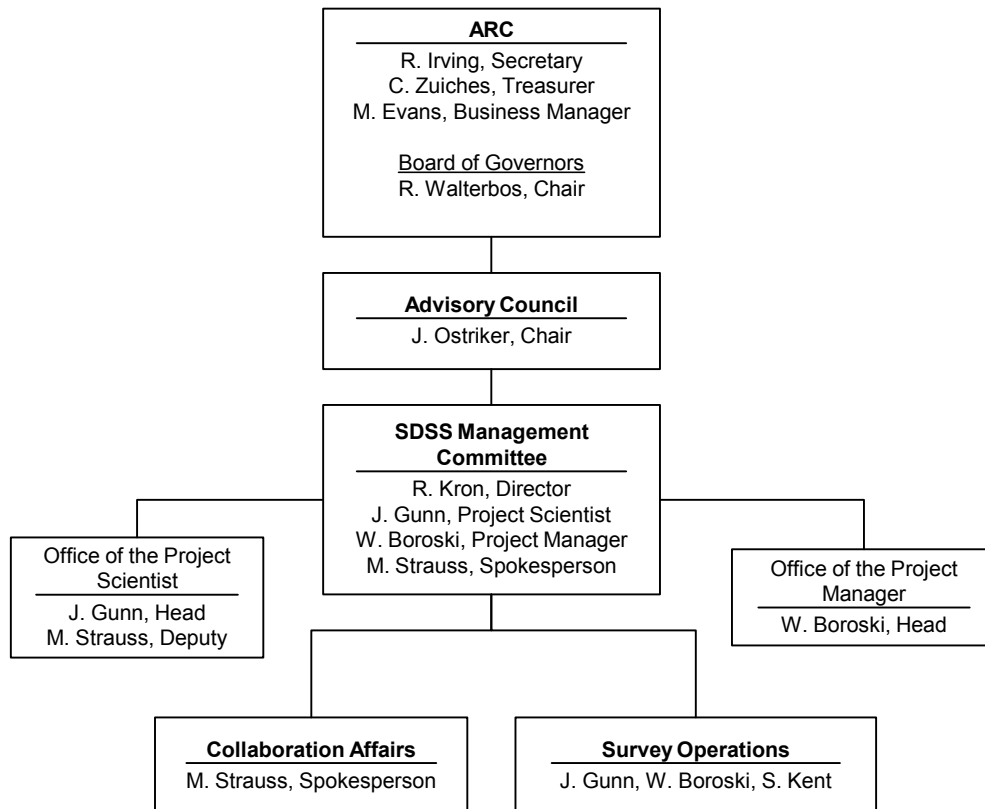
February 7, 2005

Introduction

This document describes the management of the Sloan Digital Sky Survey (SDSS-II) under the auspices of the Astrophysical Research Consortium (ARC) for the period July 2005 through November 2008. It describes the roles and responsibilities of ARC, the ARC Board of Governors, the Advisory Council, the Director, the Project Scientist, the Scientific Spokesperson, and the Project Manager. It also describes the roles and responsibilities of other senior personnel serving in key positions within the project.

The flow of accountability from the Board through the Advisory Council to the Director, and then to the Project Scientist, the Project Manager, and the Spokesperson is shown in Figure 1.

Figure 1. Organization Chart for ARC / SDSS-II Management



1. The Astrophysical Research Consortium

The Astrophysical Research Consortium (ARC) was created to provide the faculty, staff, and students from its member institutions access to modern astronomical equipment for their research and educational programs. ARC owns and operates the Apache Point Observatory (APO) near Sunspot, New Mexico. The ARC-managed facilities at APO consist of a 3.5-m general-purpose telescope and its instruments;

and the telescopes, instruments, and ancillary support systems developed for the Sloan Digital Sky Survey (SDSS).

The resources for operating ARC facilities have been provided by participating institutions and private, federal and international sources. The ARC Secretary, Ron Irving, the ARC Treasurer, Carol Zuiches, and the ARC Business Manager, Michael Evans, administer the funds received by ARC. ARC disburses some of these funds to the participating institutions through formal agreements and the remainder through contracts managed directly by ARC. New Mexico State University, an ARC member, manages the operations at APO for ARC. The ARC Business Manager directly administers large contracts with vendors when it is advantageous to ARC.

Oversight of ARC operations is the responsibility of the Board of Governors, hereafter the Board. The institutions that constitute the Board are the University of Chicago, the University of Colorado, the Institute for Advanced Study, Johns Hopkins University, New Mexico State University, Princeton University, and the University of Washington.

Two members represent each institution on the Board and the members are drawn from active scientists and senior university administrators. The Chair of the Board is Professor Rene Walterbos of New Mexico State University. The Board directly oversees the 3.5-m telescope program but created the Advisory Council to advise the Board on matters related to the SDSS, in view of the large scale of the SDSS program and the very large number of institutions participating in that program. It is anticipated that the Advisory Council will advise the Board on SDSS-II matters.

2. The Advisory Council

The Board has delegated the oversight and management of SDSS-II to the Advisory Council. The Advisory Council actions are governed by the Principles of Operation (PoO). The PoO is approved by the Board.

Institutional membership on the Advisory Council will be granted to those ARC institutions that make significant cash or in-kind contributions toward the operation of SDSS-II. Non-ARC institutions may also become full participants through Memoranda of Understanding (MOU) with ARC. These will be the Participating Institutions. Each Participating Institution may appoint two voting members to the Advisory Council.

There may also be Affiliate Members of the Advisory Council, which will be established through MOU's with ARC. Each Affiliate Member may appoint one non-voting member to the Advisory Council.

The Chair of the Advisory Council is Dr. Jeremiah Ostriker of Princeton University.

3. The Director

The Board delegates to the Director the executive authority for the operation of SDSS-II. To this end, the Director is responsible for organizing and directing all aspects of the Survey, including the appointment of key personnel. The Director is responsible for ensuring that the available resources are effectively applied toward the scientific goals described in the PoO.

The Board, taking into consideration the recommendation of the Advisory Council, appoints the Director for a fixed term. The Board appointed Richard Kron, Professor at the University of Chicago and

scientist at Fermilab, as the Director for a three-year term beginning July 1, 2003. He has arranged for reduced teaching responsibilities such that he can devote essentially full time to the project.

The Director is responsible for preparing the SDSS-II Management Plan and submitting it to the Advisory Council for approval. He leads the preparation of funding proposals for the operation of the Survey. ARC submits these proposals to federal agencies and philanthropic institutions and the Director serves as the Principal Investigator for these proposals. He is responsible for drafting, for concurrence by the Advisory Council and approval by the Board, the Memorandum of Understanding with any new Participating Institution.

The Director submits both an annual budget and a total budget for the completion of the Survey to the Advisory Council. These budgets include all funds and in-kind services needed for the operation of the Survey and for acquiring, processing, archiving, and distributing the data to the collaboration and general public. The Advisory Council transmits the Director's budgets along with its recommendations to the Board for approval.

The Director is responsible for implementing financial controls within the project. He is assisted in by the Project Manager and ARC Business Manager. The Director approves all expenditures above \$3000. The Director and ARC Business Manager approve all computer purchases in accordance with ARC corporate policy. The Project Manager tracks expenditures against the approved budget and advises the Director of financial status and performance.

The ARC corporate office, under the general supervision of the ARC Treasurer, assists the Director and Project Manager with the preparation of the annual budgets and quarterly progress reports. The ARC Business Manager provides quarterly Revenue and Expenditure Reports to the Director, Project Manager, and Advisory Council to show expenditures and obligations compared to the annual budget.

3.1. Management Committee

The Management Committee provides a forum for the discussion and framing of issues that require action by the Director and/or Advisory Council. The Director, the Project Scientist, the Project Manager and the Spokesperson constitute the Management Committee; the Director is the Chair. It examines and acts on all issues that have a broad impact on the Survey, including MOUs and other agreements that define the conditions of participation by institutions in the SDSS. When the resolution of an issue requires the approval of the Advisory Council or the Board, it reviews the matter and formulates a recommendation for action by the Advisory Council.

3.2. Project Scientist

The Director has appointed Professor James Gunn of Princeton University as the Project Scientist. The Director has delegated to the Project Scientist the responsibility for providing the overall quality assurance for the Survey and ensuring its scientific integrity. The Project Scientist monitors the performance of all systems and evaluates the scientific impact of proposed changes to hardware, software, and operating plans. He is responsible for assuring the Director that the performance of all systems will meet the scientific goals of the Survey.

The Deputy Project Scientist, Professor Michael Strauss of Princeton University, assists the Project Scientist in the implementation of his responsibilities. The Deputy Project Scientist will be responsible for developing and maintaining the Science Requirements Document. He is also responsible for reviewing and auditing other requirement documents that flow directly from the science requirements. The Office of the Project Scientist is responsible for developing and coordinating tests that will evaluate compliance

with the science requirements. The Deputy reports the results of these tests to the Project Scientist. The Project Scientist reviews the test results and recommends remedial action to the Director when the performance of equipment or software could compromise science goals.

3.3. Project Manager

The Director has appointed William Boroski of Fermilab as Project Manager. The Project Manager assists the Director in the performance of his responsibilities. The Project Manager is responsible for developing and maintaining project schedules. He is responsible for preparing annual and cost-to-complete budgets for consideration by the Director and the Project Scientist prior to their submission by the Director to the Advisory Council. He is responsible for tracking project expenditures and reporting them, together with any deviations from the approved budgets, to the Director on a timely basis. He is responsible for preparing annual and quarterly reports that are distributed to the Advisory Council and for tracking expenditures against the approved budget.

The Project Manager oversees day-to-day operations associated with Survey Operations. He coordinates the engineering effort at APO with the efforts of the engineering groups at the Participating Institutions and the requirements of the observing program. He coordinates the software effort at the Participating Institutions with the requirements of the data processing and distribution programs. He identifies resources at the Participating Institutions when additional resources are needed to meet schedules.

The Project Manager is responsible for informing the Director and the Project Scientist of the state of compliance of Survey Operations with survey metrics. He is also responsible for keeping the Director and the Project Scientist informed on the cost and schedule performance of Survey Operations.

3.4. Scientific Spokesperson

The Director has delegated the management of the affairs of the SDSS-II collaboration to the Scientific Spokesperson, hereafter referred to as Spokesperson. He has also delegated to the Spokesperson the primary responsibilities for representing the Survey to the scientific community and for raising the visibility of the Survey within the astronomy and physics communities. Accordingly, the Spokesperson oversees the publication of scientific, technical, and data release papers.

The Spokesperson is elected by a majority vote of the collaboration. In the event the Spokesperson resigns or becomes unable to serve, the Director will appoint an acting Spokesperson. Dr. Michael Strauss of Princeton University was elected spokesperson for a two-year term beginning October 1, 2003.

3.5. External Advisory Committees

The Director may form ad hoc external Advisory Committees to provide him with advice on the capabilities of the Survey to acquire and process data and to distribute the archived data products to the Collaboration and general astronomy community. These committees will review the effectiveness of observing operations, data processing, and the distribution of data to the collaboration and the astronomical community and make recommendations for improvement if survey operations do not meet the expectations of the sponsors. The members of these committees will consist of scientists (primarily astronomers), engineers, and computer professionals with experience in large projects, and who are not engaged in the Survey.

4. Survey Operations

The Director has formed Survey Operations to provide an organization to manage the operation of the Survey. The organization chart for Survey Operations is shown in Figure 2. Survey Operations consists of four technical groups – Observing Systems, Observatory Operations, Data Processing, and Data Distribution. It also includes Project Teams organized around specific scientific interests and issues. The Heads of the technical groups and the Project Teams advise the Management Committee on matters related to survey operations.

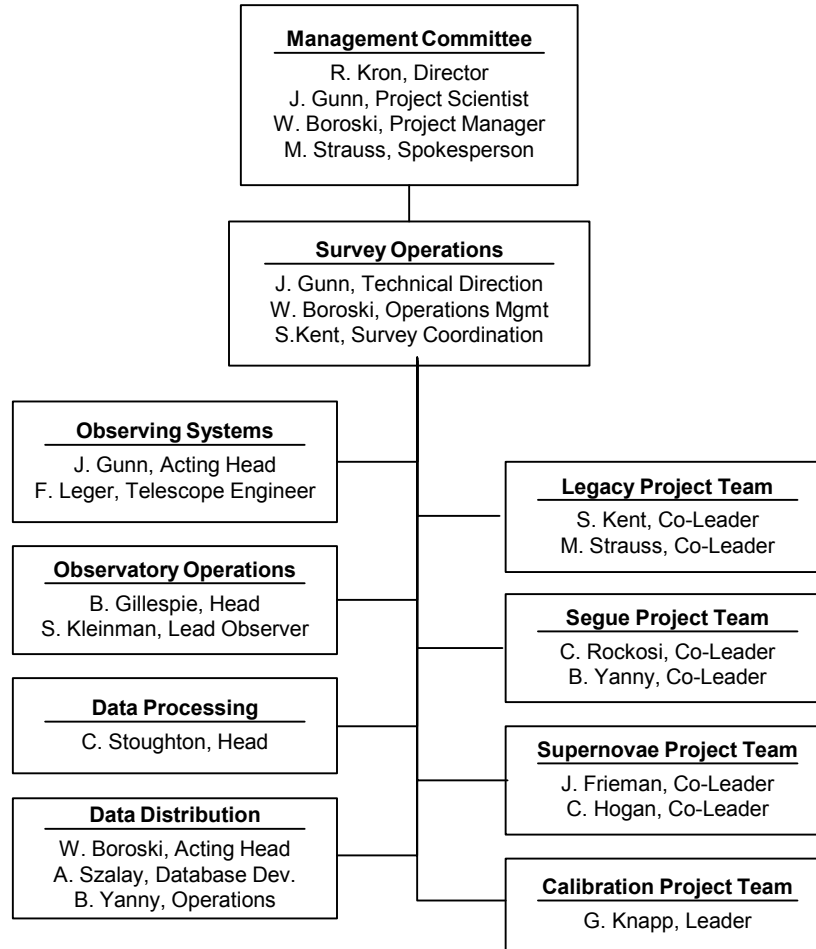
The Director appointed the Acting Head of Observing Systems, the Head of Data Processing, the Acting Head of Data Distribution, and the Project Team Leaders. ARC appointed the Site Operations Manager, Bruce Gillespie, who oversees Observatory Operations and whose assigned duties at APO are broader than just the survey.

The Project Scientist is responsible for setting the technical direction and goals of the technical groups and for reviewing the level of observatory support to assure that it is sufficient for the proper execution of the Survey. He sets priorities when the goals of the groups are in conflict.

The Project Manager is responsible for overseeing day-to-day operations of the various project components, planning the general application of resources on an annual basis, and reacting to immediate needs of the survey. The survey operations work plan is coordinated through a weekly teleconference chaired by the Project Manager. The participants in the weekly conference include the Project Scientist, Head of Survey Coordination, Site Operations Manager, Lead Observer or representative, Telescope Engineer, and key personnel at the APO site and participating institutions.

The Head of Survey Coordination provides the strategic and tactical direction of the observing program, tracks survey progress, and generates monthly observing plans. The Head of Survey Coordination also provides direction for the off-mountain efforts related to the fabrication of plug plates for spectroscopy. Stephen Kent is the Head of Survey Coordination; he is also the Head of the Fermilab Experimental Astrophysics Group. Scot Kleinman is the Deputy Head of Survey Coordination; he is also the Lead Observer. The Lead Observer is responsible for scheduling the observing staff and implementing the monthly observing plans.

Figure 2. Organization Chart for Survey Operations



4.1. Observing Systems

The Observing Systems group is responsible for maintaining the Observing Systems in an operational state throughout the observing phase of operations. The Observing Systems consist of the 2.5-m telescope, the CCD imaging camera, the dual spectrographs, the 2.5-m instrument change system, the equipment for plugging spectroscopic plates, the Photometric Telescope (PT) and its instruments, and the data acquisition system for both telescopes. The group is responsible for maintaining and improving the software used to operate the telescopes and instruments (the Observers' Programs) and the data acquisition equipment at APO. In addition, it is responsible for implementing incremental improvements that will increase the efficiency of these subsystems. Finally, it is responsible for assuring that the aforementioned systems can meet the Science Requirements. The Acting Head of Observing Systems is James Gunn.

4.2. Observatory Operations

Observatory Operations are carried out under the direction of the APO Site Operations Manager, Bruce Gillespie, who also has responsibility for managing 3.5-m telescope operations and the site at large. APO provides all of the basic services and facilities to the technical groups that are needed to carry out

their work at the site. APO provides and trains the observing staff that carries out the observations for the Survey. The Site Operations Manager is responsible for providing the observer team with office and laboratory space, onsite and offsite computer networks, and desktop computing. The Site Operations Manager is responsible to ARC for the safe conduct of all activities at the Observatory. The APO Safety Officer, Mark Klaene, provides the safety oversight of all activities at APO, establishes the qualifications for all people to engage in various tasks while working at the Observatory, and maintains their training records. In order to fulfill this responsibility, APO provides the safety training for staff engaged in activities at the Observatory.

4.3. Data Processing

The Data Processing (DP) group is responsible for all software and computer systems that are used to process the SDSS data at Fermilab. The Head of the DP group is Chris Stoughton.

The Fermilab members of the DP group, with the support of facilities and people from the Fermilab Computing Division, are responsible for processing the data obtained at APO and placing them into the Operations Database. The DP group is responsible for archiving the data and making the files available to the Collaboration.

The DP group is responsible for assuring that the quality of the data in the Operational Database and the Science Archive meets the Science Requirements. Weekly quality assurance (QA) teleconferences are held with members of the DP group, the Project Scientist, the Project Manager, the Lead Observer, the Telescope Engineer and others to review and discuss data quality matters. The forum ties together QA activities at the observatory with data processing QA activities and facilitates the prompt identification and resolution of problems should they arise. It also facilitates the development of new tests and procedures to continuously improve the effectiveness of the QA program.

Weekly teleconferences, chaired by the Deputy Project Scientist, Michael Strauss, review the state of data processing software, discuss the results of ongoing tests of the processed data, and provide a forum for setting priorities to meet survey requirements. This forum is also used to plan work needed to support future data releases.

4.4. Data Distribution

The Data Distribution (DD) group is responsible for all software and computer systems that are used to distribute the SDSS data to the collaboration and general astronomy community. Data distribution activities are coordinated by William Boroski.

Distribution of data to the Collaboration and to the public is via a web interface. There are three primary access tools: the Data Archive Server (DAS), the Catalog Archive Server (CAS), and the SkyServer. The DAS enables direct access to files in the survey archive. The CAS enables efficient searches in the database of derived parameters. The SkyServer provides a user interface designed to promote education and outreach and provide the general public with easy access to the data archive. These tools have some overlap in their functionality, but are otherwise complementary.

The CAS and SkyServer were developed by the Database Development Group at JHU, and Jim Gray of Microsoft. Dr. Alex Szalay of JHU is Head of the Database Development Group. The Database Development Group is responsible for maintaining and improving the CAS and SkyServer to support the prompt distribution of data to the collaboration, astronomy community, and general public. The group is responsible for fully documenting the CAS and SkyServer and assisting with their deployment and use by the Data Distribution Operations Group at Fermilab. The Database Development Group is also

responsible for hosting a mirror site of the most current data release, which provides a high degree of data integrity by hosting the data archive at two geographically distinct sites.

The DAS was developed at Fermilab by the DP group. The Data Distribution Operations Group, located at Fermilab, is responsible for loading and maintaining the DAS. The Data Distribution Operations Group is also responsible for setting up and managing a CAS/SkyServer production system at Fermilab, with assistance from JHU. The Data Distribution Operations Group is responsible for loading data files into the CAS, verifying data integrity, and making the CAS and SkyServer interface available for collaboration and public access in accordance with the data distribution schedule. The Data Distribution Operations Group is also responsible for supporting and maintaining the machines, disk drives and network devices used to support the DAS and CAS. Brian Yanny of Fermilab is Head of the Data Distribution Operations Group.

Weekly teleconferences, chaired by the Project Manager, review the state of the data access tools, coordinate development and implementation work, and provide a forum for setting priorities and planning work to meet data distribution requirements.

As is the case with SDSS data releases, SDSS-II participants may wish to establish informal web sites to host SDSS-II data, but ARC takes no responsibility for these sites.

4.5. Project Teams

A number of Project Teams undertake efforts that assist survey operations. These efforts include the design of target-selection algorithms, the specification of required calibrations, monitoring pipeline outputs for quality assurance of the data, optimizing the sequence of observations for the end-game, and writing technical papers. The Project Teams also serve as centers of expertise to advise on matters of the optimal observing strategy, necessary systems or software development, analysis software, the specific content of periodic data releases, and other matters related to operations. The Director, in consultation with the Management Committee, will prepare a charge for each Project Team.

The Project Team Leaders are appointed for the duration of the SDSS-II survey by the Director, in consultation with the Management Committee. Stephen Kent and Michael Strauss are co-leaders of the Legacy Project Team. Connie Rockosi and Brian Yanny are co-leaders of the SEGUE Project Team. Josh Frieman and Craig Hogan are co-leaders of the Supernovae Project Team. Gillian Knapp is leader of the Calibration Project Team.

Participants in the SDSS-II are encouraged to join Project Teams of interest to them. It is understood that with the exception of Project Team Leaders, Project Team members have no specific responsibilities with respect to survey operations.

4.6. Change Control Board

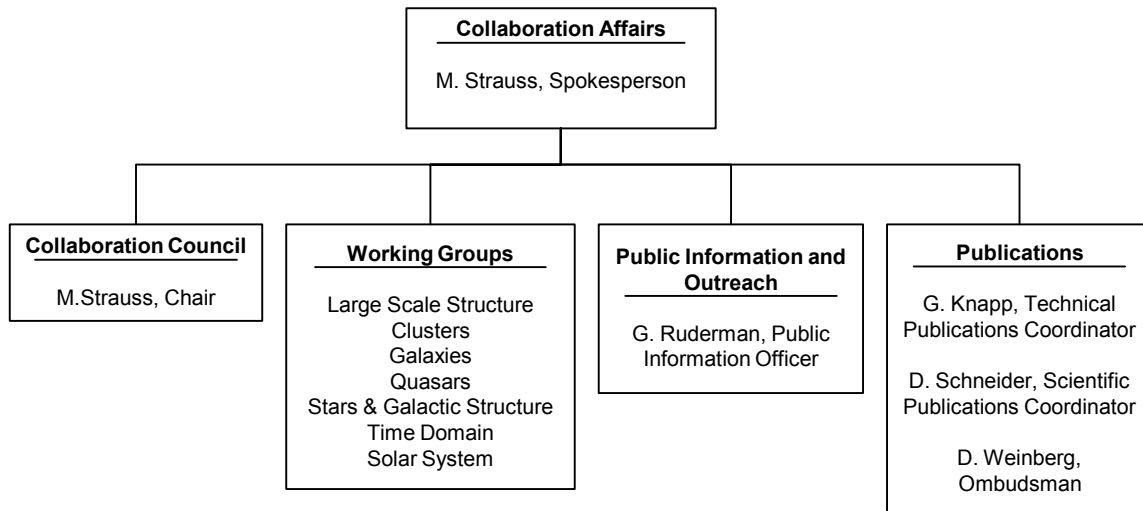
The Director has established a Change Control Board to formally receive and act on proposed significant deviations from the approved budget, schedule, and Science Requirements. The Project Scientist chairs the Change Control Board. The Project Manager prepares the agenda for the Change Control Board meetings and is responsible for distributing the decisions of the Change Control Board to the Director for approval and to others for action as appropriate.

5. Collaboration Affairs

The Collaboration consists of scientists from the Participating Institutions. Its membership also includes scientists from non-participating institutions who have earned data access rights through their contributions to the Survey infrastructure. Its membership also includes external collaborators who provide expertise on specific projects.

The Collaboration provides opportunities for its members to exchange information and ideas freely, thereby assisting the pursuit of their individual research goals. Collaboration Affairs was formed to accomplish these goals. The organization chart for Collaboration Affairs is shown in Figure 3.

Figure 3. Organization Chart for Collaboration Affairs



The Spokesperson is responsible for organizing Collaboration Affairs and selecting the Collaboration Council Chair, the Technical Publications Coordinator, the Scientific Publications Coordinator, and the Ombudsman. A major responsibility of the Spokesperson is to create a healthy collegial environment in which the pursuit of the scientific goals of the Survey can flourish. Special attention is paid to the mentoring of postdocs and graduate students, and to rules governing graduate student theses involving Survey data. The principles guiding the work of the Collaboration are spelled out in the PoO, Publications Policy, and similar documents. As required, the Spokesperson is responsible for proposing and/or revising collaboration-specific policies for approval by the Management Committee and the Advisory Council.

The Spokesperson arranges for the organization of presentations at the meetings of professional societies, in the course of discharging his responsibilities for representing the Survey to the scientific community and for raising the visibility of the Survey within the astronomy and physics communities. He consults CoCo on these matters and brings them to the attention of the Management Committee. The Spokesperson has created a Publications Office in order to provide the Collaboration with a means to oversee the preparation of technical and scientific publications.

The Spokesperson, with the help of CoCo, solicits offers from Participating Institutions to hold Collaboration meetings at roughly six-month intervals. The organization and agenda for each meeting is the responsibility of the local organizing committee. The agenda and special events are reviewed and approved by the Spokesperson in consultation with the CoCo.

5.1. Collaboration Council

The Collaboration Council (CoCo) assists the Spokesperson in the management of Collaboration Affairs. It provides advice to the Spokesperson on all Collaboration matters, including recommendations for policies on publications, scientific representation, and science projects. The membership consists of one person from each Participating Institution who is appointed by the scientist member of the Advisory Council from that institution. In addition, one of the External Participants is elected by the External Participants to serve on CoCo. Michael Strauss currently serves as the Chair of CoCo, but the Spokesperson may delegate that responsibility.

The Chair of CoCo is responsible for ensuring that CoCo meets regularly to discuss matters pertaining to the health of the Collaboration and to advise the Spokesperson.

CoCo is responsible for reviewing proposals for science projects that include external collaborators. External collaborators bring special expertise to a particular project and the capacity to enable the project so that its results can be published in a timely way. In exchange for their assistance, external collaborators are given access to the data appropriate for the specific project and become eligible for authorship on that research.

CoCo is responsible for organizing and conducting the election of the Spokesperson. The election is conducted three months before the expiration of the term of the current Spokesperson.

5.2. Working Groups

The Working Groups (WGs) facilitate the work on the science goals of SDSS-II. The Collaboration and the Working Groups are organized to allow individual scientists a great deal of freedom in pursuing their scientific projects. For example, any participant may join in any project. Working Groups were formed to address specific topics, including large scale structure, clusters, galaxies, quasars, stars and Galactic structure, time domain, and solar system. The Director, on the recommendation of the Project Scientist and the Spokesperson, may create a new WG or dissolve an existing WG.

The Spokesperson will prepare a charge for each WG. The Spokesperson is responsible for providing the charge to the WGs and to review their activities from time to time.

The Working Group chairs are appointed for the duration of the SDSS-II survey by the Director, based upon recommendations from the Spokesperson.

5.3. Public Information and Outreach

The Director has established a public affairs office to handle press releases and communication with the news media. The Spokesperson oversees the Public Information Officer, who is the primary channel of communication with the media. The Spokesperson is responsible for providing the Public Information Officer with the scientific and technical information that will be distributed in press releases and other communications with the media.

The Public Information Officer is responsible for coordinating and organizing the work of the Public Information Officers at the other Participating Institutions in order to assure that the interests of all of the Survey sponsors are properly served.

5.4. Publication Office

The Spokesperson oversees the Publications Office, which provides a means to disseminate scientific results in draft form to the collaboration. This enables review of the scientific content of draft papers.

The Scientific Publications Coordinator and the Technical Publications Coordinator are appointed for the duration of the SDSS-II survey by the Spokesperson. The Spokesperson maintains a web page on www.sdss.org listing all published papers and papers approved for publication in refereed journals. These papers include papers posted on astro-ph and conference proceedings. A separate, internal web page, accessible only to the Collaboration, is maintained for work in progress prior to its acceptance for publication. Policies and procedures for the publications are posted on www.sdss.org.

The Ombudsman is appointed by the Spokesperson for the duration of the SDSS-II survey. The Ombudsman is responsible for resolving conflicts that arise on matters related to publications when they are brought to his or her attention.